WHAT IS CLAIMED:

1. A method for preparing particles of a platinum metal element on a carbon substrate that comprises the steps of:

(a) contacting a carbon substrate with an aqueous solution of a dissolved platinum metal element complex present at a pH value of about 2 to about 4 where said platinum metal element is present as an anionic complex and at a pH value of about 10.5 to about 13 where said platinum metal element is present as a cationic complex, whereby use of a carbon substrate having a higher PZC value at said low pH values or a carbon substrate having a lower PZC at said high pH values provides greater adsorption of said platinum metal element complex than the reverse usage;

(b) maintaining said contact at said pH value for a time period sufficient for said platinum metal element complex to adsorb onto said substrate to form a platinum metal complex-loaded substrate;

(c) heating said platinum metal complex-loaded substrate under reducing conditions to form particles of a platinum metal element on said carbon substrate.

2. The method according to claim 1 wherein said carbon substrate has a surface area of about 100 to about 2500 m^2/g.

3. The method according to claim 1 wherein said platinum metal complex-loaded substrate is heated at a temperature of about 200° to about 300° C.

4. The method according to claim 1 wherein said anionic complex is a halo or halohydroxoaquo complex.

5. The method according to claim 1 wherein said cationic complex comprises one or more nitrogen atoms contained in a monodentate, bidentate or tridentate ligand.

6. A method for preparing particles of a platinum metal element on a carbon substrate that comprises the steps of:

(a) contacting a carbon substrate having a surface area of about 100 to about 2500 m^2/g with an aqueous solution of a dissolved platinum metal element complex present at a pH value of about 2 to about 4 where said platinum metal element is present as an anionic complex, whereby use of a carbon substrate having a higher PZC value at said pH values provides greater adsorption of said platinum metal element complex than does use of a substrate having a lower PZC value;

(b) maintaining said contact at said pH value for a time period sufficient for said platinum metal element complex to adsorb onto said substrate to form a platinum metal complex-loaded substrate;

(c) heating said platinum metal complex-loaded substrate under reducing conditions at a temperature of about 200° to about 300° C to form particles of a platinum metal element on said carbon substrate.

7. The method according to claim 6 wherein said anionic complex is a halo or halohydroxoaquo complex.

8. The method according to claim 7 wherein said halo or haloaquo complex is a chloro or chlorohydroxoaquo complex.

9. The method according to claim 8 wherein said chloro or chlorohydroxoaquo complex is selected from the group consisting of $PtCl_4^{2-}$, $PtCl_6^{2-}$, $PtCl_5^{2-}$, $PdCl_4^{2-}$, $[RhCl_4(H_2O)_2]^-$, $[RhCl_5(H_2O)]^{2-}$, $[IrCl_5(H_2O)]^-$, $RhCl_6^{3-}$, $IrCl_6^{3-}$, $OsCl_6^{2-}$ and $[RuCl_4(H_2O)_2]^-$.

10. A method for preparing particles of a platinum metal element on a carbon substrate that comprises the steps of:

(a) contacting a carbon substrate having a surface area of about 100 to about 2500 m^2/g with an aqueous solution of a dissolved platinum metal element complex present as a cationic complex at a pH value of about 10.5 to about 13, whereby use of a carbon substrate having a lower PZC at said pH value provides greater adsorption of said platinum metal element complex than does use of a substrate having a higher PZC;

(b) maintaining said contact at said pH value for a time period sufficient for said platinum metal element complex to adsorb onto said substrate to form a platinum metal complex-loaded substrate;

(c) heating said platinum metal complex-loaded substrate under reducing conditions at a temperature of about 200° to about 300° C to form

particles of a platinum metal element on said carbon substrate.

11. The method according to claim 10 wherein said cationic complexes includes one or more nitrogen atoms contained in a monodentate, bidentate or tridentate ligand, or said one or more nitrogen atoms and water from an amminoaquo complex.

12. The method according to claim 11 wherein said cationic complex containing a monodentate, bidentate or tridentate ligand is an ammine, pyridine ,ethylenediamine, 1,3-propanediamine, 1,10-phenanthroline, 2,2'-bypyridine or diethylenetriamine ligand.

13. The method according to claim 12 wherein said ammine-containing cationic complex is selected from the group consisting of $Ru(NH_3)_5(H_2O)]^{2+}$, $[Ru(NH_3)_5(H_2O)]^{3+}$, $[Ru(bipy)_3]^{2+}$, $[Os(bipy)_3]^{2+}$, $Rh(NH_3)_6^{3+}$, $Ir(NH_3)_6^{3+}$, $Pd(NH_3)_4^{2+}$, $Pt(en)^{2+}$, $Pd(py)_2^{2+}$, and $[Pt(en)_2]^{2+}$.